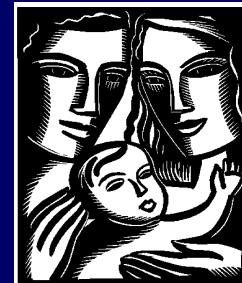


Weapons of Mass Destruction (WMD) Treatment Guidelines: A Case Study Presentation

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Gregory M. Bogdan, PhD**

**Rocky Mountain Poison
and Drug Center**



**D E N V E R
H E A L T H**

Your Community Health Partner

Project Goal

- Consensus treatment guidelines for WMD agent exposures that provide health care professionals with appropriate treatment regimes.

☞ Chemical & Biological Agents

☞ Pre-Hospital & Hospital Care Providers

☞ Known Exposure & Clinical Presentation

Presentation Overview

- Brief Review of Treatment Guideline Development Process
- Chlorine Guideline
 - Case Presentations

Project Objectives

- Revise Agent-based 1996 Atlanta Protocols
 - Chemical Agents (6)
 - Biological Agents (7)
 - Antidotes (5)
- Create Symptom-based Guidelines

Atlanta Protocols

Simple

Algorithmic

Real-Time

Provider Specific

Mass Casualties

TREATMENT PROTOCOL

Chlorine

1. General:

Chlorine is found as a greenish-yellow gas. There is a pungent, acrid, characteristic odor. Sensitivity to the odor is below toxic levels; however, since some sensory adaptation occurs, repeat exposures are more likely to produce toxic effects. Exposures irritate eyes and central (upper) airways within minutes. Low doses produce some cough and choking sensation. Moderate doses also produce a sense of suffocation, hoarseness, and substernal pain. High doses also produce a severe dyspnea, with pulmonary edema, nausea, vomiting, headache, syncope also seen. Very high doses may produce sudden death without obvious pulmonary lesions-possible via laryngospasm. All recognized exposures should be referred for direct observation/care.

2. Patient Evaluation:

- a. Victim should be immediately removed from the toxic environment by fully masked personnel. Chemically protective clothing is required for liquid/solution exposures.
- b. Liquid contamination causes eye and skin burns on contact. Contaminated clothing should be removed/disposed of.

3. Treatment:

- a. Eyes: Liquid exposures should be flushed with copious quantities of water; medical attention should be sought. Gas exposures, if symptomatic, should be flushed with water. Medical attention should be sought if symptomatic.
- b. Skin: Liquid exposures should be flushed with copious quantities of water. Contaminated clothing should be removed/disposed of. Gas exposures require no specific therapy unless symptomatic. Intense gas exposure produces burns; wash with water.
- c. Breathing: Evaluate respiration, cyanosis, and bronchospasm.

If apnea: CPR with intubation. Be aware that laryngospasm may be present with intense exposures hence intubation may be very difficult and tracheotomy could be required. Medical attention should be sought.

Atlanta Protocols

Simple

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Chlorine Treatment (continued)

Note: The anatomical configuration of infants and children's airways makes wheezing a less reliable indicator of bronchospasm. Severe smaller airway constriction with resultant hypoxia may be present. Any apparent infant or child distress should be immediately assessed with oximetry.

If bronchospasm: Provide aggressive bronchodilation:

Adult:

Inhaled albuterol: unit doses q 2 hr.

Steroids: methylprednisolone, load 120 mg, then 60 mg 6hr.

Theophylline: load 150 mg. Then 30 mg/hr.

Infants and children (0-12 yr.):

Inhaled albuterol: 0.15 mg/kg per nebulized dose

Up to 5 mg/20 minutes for first 2 hr.

Steroids: methylprednisolone, load 125 mg, then 60-mg q 6 hr.

Theophylline: 10-mg/kg/24 hr.

Elderly:

Inhaled albuterol: unit doses q 3 hr.

Steroids: methylprednisolone, load 125 mg, then 60-mg q 6 hr.

Theophylline (occasional use): load 100 mg, then 25 mg/hr.

If asymptomatic: Maintain direct observation for at least 1 hour

If becomes symptomatic, treat as above.

If still asymptomatic, lesser observation for additional 12 hours since some bronchospasm may appear late.

If hypoxic from bronchospasm bronchodilators and supplemental oxygen form pulmonary edema: oxygen may be utilized with positive pressure (e.g., PEEP 5-7 cm or intubation).

If pulmonary edema (occurs with very severe exposures): Treat as noncardiac pulmonary edema (Adult Respiratory Distress Syndrome or ARDS) with PEEP 5-7 cm and/or intubation. Diuretic therapy risks severe hypotension if intubation is required.

If infection: Inhalational exposures may produce pulmonary infiltrates, fever, and white blood cell elevations leading to an erroneous diagnosis of (presumed bacterial) pneumonia. Prophylactic antibiotics are not indicated. Surveillance bacteriologic cultures are obtained anticipating an approximate 50% risk of nosocomial pneumonia at days 3-6.

If pain: Airway discomfort may benefit from codeine. Be wary of sedation.

Guideline Assumptions

- Rarely Utilized
- Need Algorithm Design
- Agent Identity May Be Unknown
- Most Patients Will Self-Report
- Decontamination Procedures To Be Incorporated

How Do We Develop New Guidelines?

- Individual expertise
- Consensus Panel
- Evidence-Based Medicine
 - **A philosophy involving inductive reasoning which is based on a balanced and thorough analysis of available evidence.**

(Evidence-Based Medicine Working Group. Evidence-Based Medicine. JAMA 1992;268:2420-2425)

Consensus Panel Members

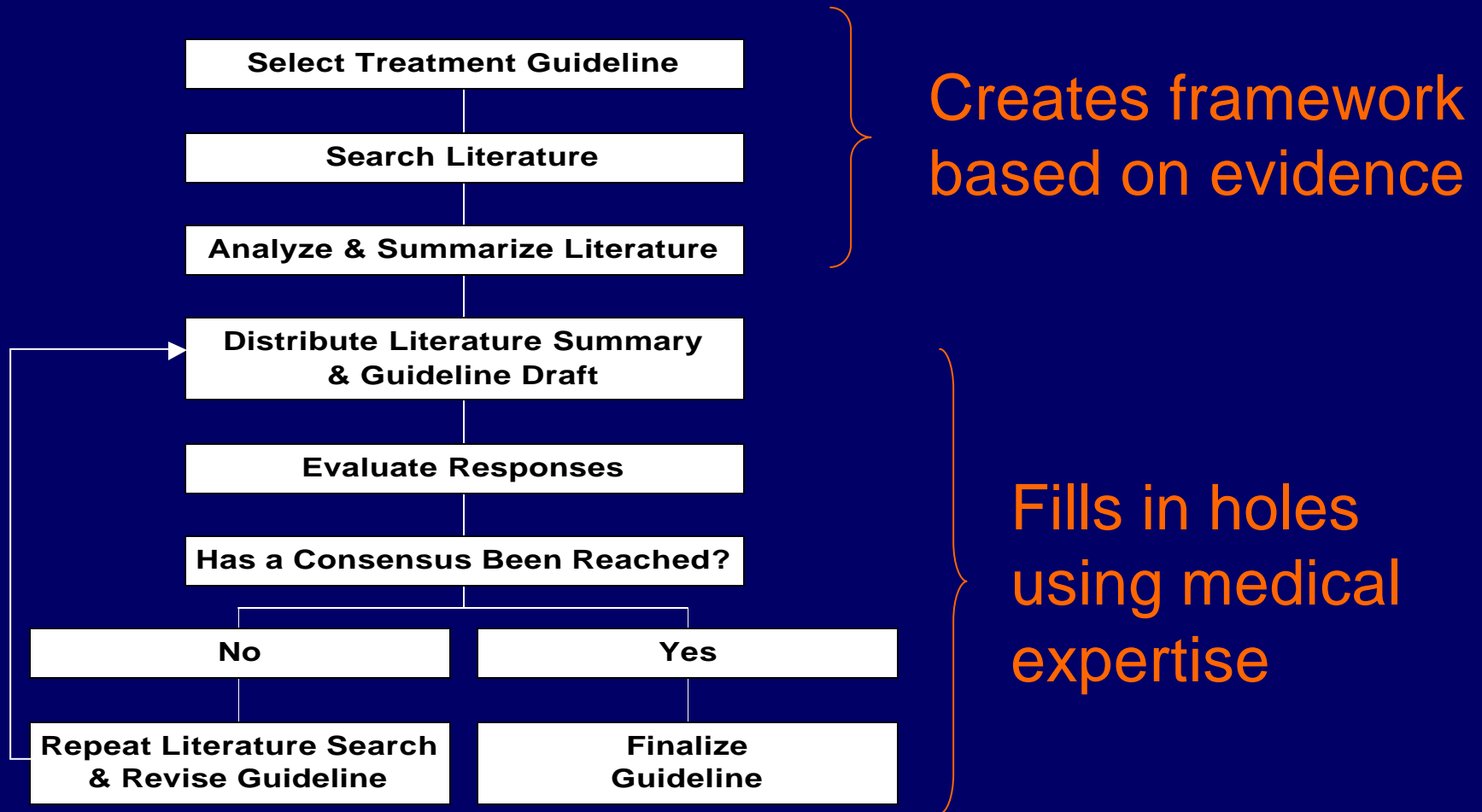
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Robert Geller, MD
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Thomas Inglesby, MD
Steven Joyce, MD

Ali Kahn, MD
Ed Kilbourne, MD
Mark Keim, MD
Mark Kirk, MD
James Madsen, MD
Michael Shannon, MD
Frederick Sidell, MD
Chief Richard Stilp, RN
Steven Scott, MD
Richard Thomas, PharmD
Cdr. Kevin Tonat, DrPH

EBM + Consensus Process

- Encourages use of appropriate data to develop consensus conclusions.
- Potentially combines strengths of both procedures.

EBM + Consensus Process



Chemical Agents

- **Chlorine**
- **Nerve Agents**
- **Sulfur Mustard**
- **Cyanogens**
- **Isocyanates**
- **Phosgene, Carbonyl Chloride**

Interpreting the Medical Literature

It Has Long Been Known...

It Has Long Been Known...

I couldn't find the reference

In My Experience... Once

In My Experience... Once

In Case After Case... Twice

In My Experience... Once

In Case After Case... Twice

In A Series of Cases... Three times

Additional Work Is Needed...

Additional Work Is Needed...

Maybe then our results will
begin to make sense.

Thanks to my research team.

Thanks to my research team.

They actually did the work

NBC Guidelines

Page 1

ROUGH DRAFT

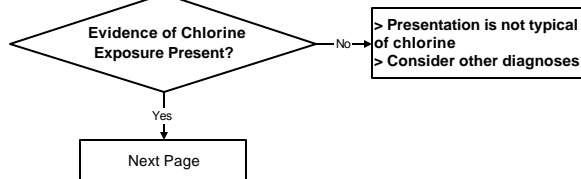
Chemical Mass Casualty Incident Chlorine Guideline - Emergency Department

General

1. Guideline assumes that chlorine exposure is known and is the only exposure.
2. Guideline assumes that initial assessment (brief history and physical exam) have been performed.
3. This guideline focuses on the diagnosis and treatment specific to a multiple chlorine-exposed patients presenting to the emergency department.
4. This is a guideline, treatment must be tailored to the needs of specific patients.

Chlorine-Specific History	Interpretation
General circumstances of exposure?	Green-yellow gas or mist may indicate chlorine
Odor?	Chlorine or swimming pool odor often reported.
Multiple casualties?	Common with chlorine gas/mist.
Time since exposure?	Chlorine-induced symptoms usually develop within minutes.
Closed space exposure? Duration of Exposure?	Severity of illness usually related to duration and intensity of exposure
Irritation, itching, burning or increased secretions from mucous membranes?	Nearly always present with chlorine exposure.
Wheezing, cough, dyspnea, chest pain, sputum production.	Common with chlorine exposure.

Chlorine-Specific Physical Examination	Interpretation
Lacrimation, rhinorrhea, cough, sputum production, conjunctivitis, pharyngeal injection, hoarseness	Uniformly present with clinically significant chlorine inhalation.
Tachypnea, wheezing, use of accessory muscles of respiration, stridor, rhonchi, rales, pulmonary edema, frothy sputum, hemoptysis.	Common with clinically significant chlorine inhalation.
Other: skin irritation or burns, hypertension, tachypnea, cyanosis, photophobia, vomiting, syncope, restlessness, diaphoresis, inability to speak, coma	Consistent with chlorine inhalation, but not particularly characteristic of exposure.



Page 2

ROUGH DRAFT

Chlorine Guideline - Emergency Department, cont.

Yes ↓

Perform Additional Assessment		
Test	High Volume	Low Volume
Pulse Oximetry	??	All patients with respiratory exposure
Serum electrolytes, BUN, Creatinine	Not Recommended	As indicated by complications or therapies used (e.g. diuretics)
Arterial Blood Gases	Not Recommended	Clinically significant hypoxemia or retention of carbon dioxide is suspected
Chest Radiograph	Not Recommended	Patients with significant symptoms (e.g. dyspnea, cough), hypoxemia or abnormalities on chest or lung field exam.
Peak flow or Spirometry monitoring	Not Recommended	Consider to help guide therapy in patients with bronchospasm
Electrocardiogram	Not Recommended	Patients with chest pain

↓

Initial Treatment		
Indication	High Volume	Low Volume
Dyspnea, Tachypnea, Hypoxia	Oxygen by nasal cannula, followed by endotracheal intubation, if needed	Oxygen by nasal cannula or face mask to produce oxygen saturation > 90%, followed by endotracheal intubation, if needed
Wheezing, Use of accessory muscles of respiration	Beta2 agonist only??	NaHCO3 inhalation - Details needed Beta-2 receptor agonist - Details needed
Severe wheezing, stridor	Endotracheal intubation and artificial respiration	
Pulmonary edema (rales, frothy sputum, hemoptysis)	Treatment?	
Pain	Identify source and treat appropriately	
Prophylaxis of Infection	Pulmonary toilet should be provided. Antimicrobial prophylaxis is not indicated.	
Skin Contamination	Decontamination needed for chlorine unless visible substance on skin	

↓

Continuing Care
<u>Wheezing:</u> <u>Hypoxia:</u> <u>Pulmonary Edema:</u> <u>Cutaneous Burns:</u> <u>Coma:</u>

OEP Guidelines

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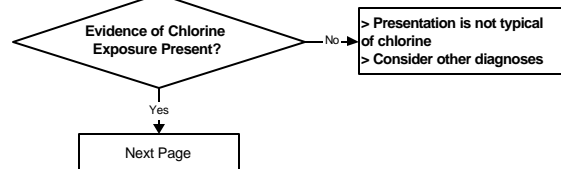
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“Atlanta Protocols”

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3. Treatment:

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- b. Skin: Liquid exposures should be flushed with copious quantities of water contaminated clothing should be removed/disposed of. Gas exposures require no specific therapy unless symptomatic. Intense gas exposure produces burns; wash with water.
- c. Breathing: Evaluate respiration, cyanosis, and bronchospasm.

If apnea: CPR with intubation. Be aware that laryngospasm may be present with intense exposures hence intubation may be very difficult and tracheotomy could be required. Medical attention should be sought.

Comparison of Guidelines

- Chlorine-Specific History
 - General circumstances of exposure? Odor?
 - Green gas, swimming pool odor suggest chlorine
- Huh?
- Chlorine is found as a greenish-yellow gas. There is a pungent, acrid, characteristic odor.
- Sensitivity to the odor is below toxic levels; however, since some sensory adaptation occurs, repeat exposures are more likely to produce toxic effects.

Patient Scenario

- Three children and two adults present after a terrorist sprays liquid chlorine into a municipal pool area.

Symptoms/Signs

- #1 Dyspnea, wheezing, lethargy, throat/eye irritation
- #2 Wheezing, throat irritation, chest pain and tightness, anxiety
- #3 Chest tightness, anxiety
- #4 Wheezing
- #5 Slight eye irritation

History

Chlorine-Specific History

General circumstances of exposure?

Odor?

Multiple casualties?

Time since exposure?

Closed space exposure? Duration of Exposure?

Irritation, itching, burning or increased secretions from mucous membranes?

Wheezing, cough, dyspnea, chest pain, sputum production.



Physical Examination

Chlorine-Specific Physical Examination

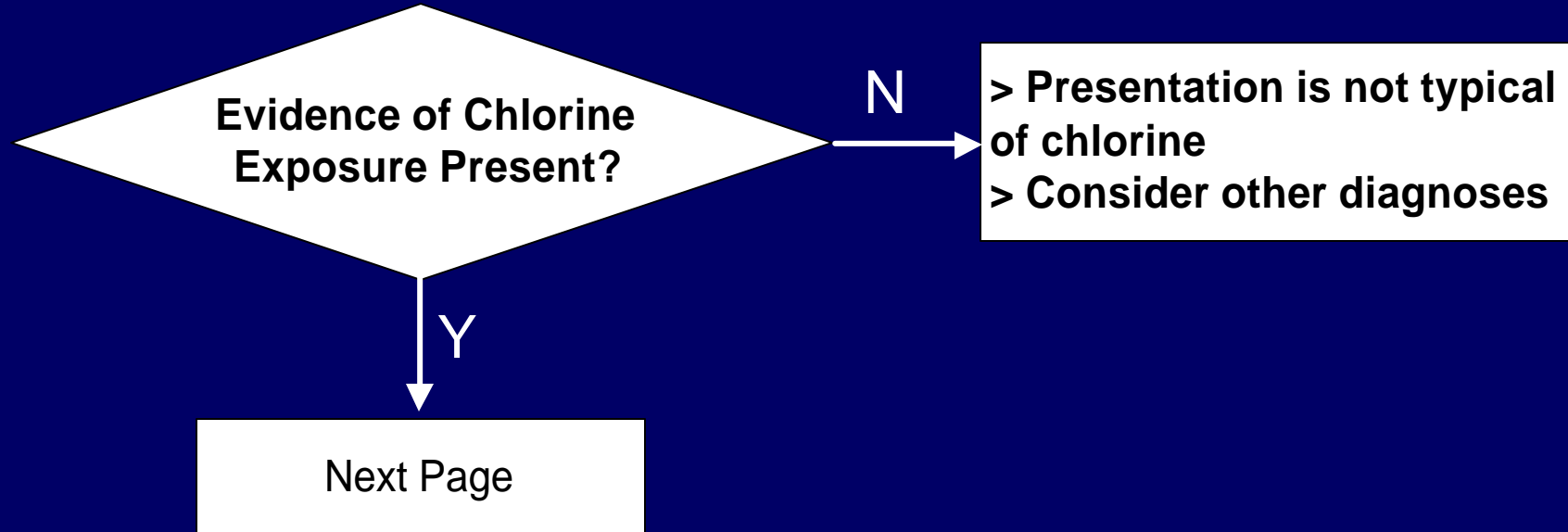
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Other: skin irritation or burns, hypertension, tachypnea, cyanosis, photophobia, vomiting, syncope, restlessness, diaphoresis, inability to speak, coma



Decision Point



Additional Assessment



Perform Additional Assessment	
Test	
Pulse Oximetry	
Serum electrolytes, BUN, Creatinine	
Arterial Blood Gases	
Chest Radiograph	
Peak flow or Spirometry monitoring	
Electrocardiogram	



Additional Assessment

Test
Pulse Oximetry
Serum electrolytes, BUN, Creatinine
Arterial Blood Gases
Chest Radiograph
Peak flow or Spirometry monitoring
Electrocardiogram

Low Volume
All patients with respiratory exposure
As indicated
Clinically significant hypoxemia or retention of carbon dioxide suspected
Patients with significant, hypoxemia or abnormalities on pulm. exam.
Consider to help guide therapy in patients with bronchospasm
Patients with chest pain

Additional Assessment

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Treatment

Initial Treatment		
Indication	Treatment	
	High Volume	Low Volume
Dyspnea, Tachypnea, Hypoxia		
Wheezing, Use of accessory muscles of respiration		
Severe wheezing, stridor		
Pulmonary edema (rales, frothy sputum, hemoptysis)		
Pain		
Prophylaxis of Infection		
Skin Contamination		



Treatment

Initial Treatment		
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Wheezing, Use of accessory muscles of respiration	Beta2 agonist only??	NaHCO3 inhalation - Details needed Beta-2 receptor agonist - Details needed
Severe wheezing, stridor	Endotracheal intubation and artificial respiration	
Pulmonary edema (rales, frothy sputum, hemoptysis)	Treatment?	
Pain	Identify source and treat appropriately	
Prophylaxis of Infection	Pulmonary toilet should be provided. Antimicrobial prophylaxis is not indicated.	
Skin Contamination	Decontamination needed for chlorine unless visible substance on skin	



EMS Version of Guidelines

- Same Ground Rules

☞ Simple

☞ Algorithmic

☞ Real-Time

☞ Provider Specific

☞ Mass Casualties

EMS Version - Hx and PE

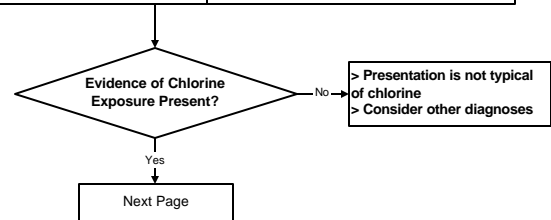
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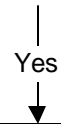
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EMS Version - Assessment

ROUGH DRAFT

Chlorine Guideline - Emergency Department, cont.



Perform Additional Assessment		
Test	High Volume	Low Volume

EMS Version - Treatment

Initial Treatment		
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Pulmonary edema (rales, frothy sputum, hemoptysis)	Treatment?	
Pain	Identify Source and Treat Appropriately	
Prophylaxis of Infection	Pulmonary toilet should be provided. Antimicrobial prophylaxis is not indicated.	
Skin Contamination	Decontamination not needed for chlorine unless visible substance on skin	

Conclusions

- Large complex groups are difficult to manage!
- Evidence of adequate quality is lacking for most NBC topics.
- Personal assessment differs widely even among thoughtful professionals.
- Combined EBM and consensus process combines the strengths of each while decreasing weaknesses.